

## SECTION 27 1000

### STRUCTURED CABLING

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#### LANL MASTER SPECIFICATION

When editing to suit project, author shall add job-specific requirements and delete only those portions that in no way apply to the activity (e.g., a component that does not apply). To seek a variance from applicable requirements, contact the ESM Electrical POC.

When assembling a specification package, include applicable specifications from all Divisions, especially Division 1, General Requirements.

Delete information within "stars" during editing.

Specification developed for ML-3 projects. For ML-1 / ML-2, additional requirements and QA reviews are required.

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#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

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Edit list to match project requirements.

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- A. Telecommunications pathways including conduit and cable tray systems.
- B. Telecommunications terminal boards.
- C. Installation, termination, and testing of LANL-furnished horizontal cables and outlets.
- D. Installation of LANL-furnished telecommunications backbone cables.
- E. Installation, termination, and testing of LANL-furnished television horizontal coaxial cables, connectors and, outlets.

##### 1.2 DEFINITIONS

- A. Refer to NECA/BICSI 568 Standard for Installing Commercial Building Telecommunications Cabling for definitions of terms used in this Section.

##### 1.3 LANL FURNISHED EQUIPMENT FOR CONTRACTOR INSTALLATION (GFE)

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Edit list to match project requirements. Coordinate with the LANL Telecommunications Group.

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- A. LANL will furnish the Category 6A UTP horizontal cable required to connect telecommunications outlets.

- B. LANL will furnish telecommunications outlet/connectors.
- C. LANL will furnish telecommunications backbone cables.
- D. LANL will furnish the coaxial cable required to connect the television outlets.
- E. LANL will furnish the television outlets and connectors.

#### 1.4 LANL FURNISHED AND INSTALLED EQUIPMENT

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 Edit list to match project requirements. Coordinate with the LANL Telecommunications Group.  
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- A. LANL will furnish and install telecommunications entrance cable.
- B. LANL will furnish and install cross-connect equipment.
- C. LANL will furnish and install telecommunications systems electronics equipment.
- D. LANL will furnish and install television system electronics equipment.

#### 1.5 LANL PERFORMED WORK

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 Edit list to match project requirements. Coordinate with the LANL Telecommunications Group.  
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- A. LANL will terminate telecommunications backbone cables.
- B. LANL will spot-check acceptance tests on Category 6A UTP cables.

#### 1.6 SUBMITTALS

- A. Within 30 days after construction Notice to Proceed, submit certifications of the qualifications of the Category 6A UTP horizontal cable installer as described in Paragraph 1.7 of this Section.
- B. Detailed records of cable routing in accordance with ANSI/TIA/EIA-606-A Administration Standard for the Telecommunications Infrastructure.
- C. Provide test reports for each installed and terminated Category 6A UTP horizontal cable in accordance with ANSI/TIA/EIA-568-B.2 Commercial Building Telecommunications Cabling Standard.

#### 1.7 QUALITY ASSURANCE

- A. Conform to the requirements of the following telecommunications standards:
  - 1. ANSI/TIA/EIA-568-B.1 – B.3 Commercial Building Telecommunications Cabling Standard.

2. ANSI/TIA/EIA-569-A Commercial Building Standard for Telecommunications Pathways and Spaces.
  3. ANSI/TIA/EIA-606-A Administration Standard for the Telecommunications Infrastructure.
  4. ANSI/J-STD-607-A Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
  5. NECA/BICSI 568 Standard for Installing Commercial Building Telecommunications Cabling.
- B. Conform to the requirements of the National Electrical Code (NEC).
- C. Category 6A UTP cable installers shall have the following minimum qualifications:
1. BICSI Registered Installer Level 1 or equivalent certification plus successful completion of Systimax Installer Training that includes installation and termination of Category 6A cable.

## 1.8 COORDINATION

- A. Coordinate telecommunications service and interior distribution with the LANL Telecommunications Group.
- B. Coordinate installer training and cable termination tool requirements for horizontal cabling installers with the LANL Telecommunications Group.
- C. Schedule completion of the telecommunications rooms to allow not less than 5 working days for the LANL Telecommunications Group to install cross-connect equipment before the scheduled start of cable installation. Coordinate schedule with the LANL Telecommunications Group.
- D. Order horizontal cabling and outlet/connectors from the LANL Telecommunications Group based on actual count, measurement of conduit and cable tray runs and required slack cable. Place order not less than 10 working days prior to scheduled start of installation.
- E. Schedule installation of horizontal cabling and outlet/connectors to start after the completion of application of finishes to walls and after the completion of the telecommunications room(s) to minimize potential for damage to cables.

## PART 2 PRODUCTS

### 2.1 CONDUIT

- A. Provide conduits for service, backbone, and horizontal cables as indicated on the Drawings or as required for a complete telecommunications pathway system.

- B. Select sizes of conduit for horizontal cables on the following basis:
- a. Less than 50 ft between pulling points and only one bend: 40 percent conduit fill.
  - b. More than 50 ft between pulling points or two 90-degree bends: 31 percent conduit fill.
  - c. Minimum conduit size: 1-inch unless specified otherwise.
  - d. Cable diameter: 0.31 inches.
  - e. Number of cables per conduit: 4 cables per workstation unless specified otherwise.
- C. Refer to Section 26 0533, Raceways and Boxes for Electrical Systems.

## 2.2 RACEWAY MEASURING TAPE

- A. Refer to Section 26 0533, Raceways and Boxes for Electrical Systems.

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Edit the following article to match project requirements. Delete if not required  
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## 2.3 SURFACE METAL RACEWAY

- A. Refer to Section 26 0533, Raceways and Boxes for Electrical Systems.

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Edit the following article to match project requirements. Delete if not required  
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## 2.4 CABLE TRAY

- A. Provide cable tray system for backbone cables and horizontal cables as indicated on the Drawings or as required for a complete telecommunications pathway system.
- B. Provide ladder type cable tray with maximum 6 inch rung spacing.
- C. Select cable tray sizes for horizontal cables based on the larger of:
- a. 1 sq. in. of cable tray per 100 sq. ft. of useable floor area served, or
  - b. 41.6 percent fill ratio.
- D. Refer to Section 26 0536, Cable Trays for Electrical Systems.

## 2.5 OUTLET BOXES

- A. Refer to Section 26 0533, Raceways and Boxes for Electrical Systems.
- B. Use 4-11/16 inch square, 2-1/8 inch deep outlet boxes with single gang raised device covers for telecommunications and television outlets served by 1-1/4 inch or smaller conduit.

## 2.6 PULL AND SPLICE BOXES

- A. Refer to Section 26 0533, Raceways and Boxes for Electrical Systems.
- B. Provide pull and splice boxes with dimension indicated in TIA/EIA-569-A.

- 1. Provide boxes for straight pulls with the following minimum dimensions:

Conduit trade-size	Width (inches)	Length (inches)	Depth (inches)	Width increase per additional conduit (inches)
1	4	16	3	2
1-1/4	6	20	3	3
1-1/2	8	27	4	4
2	8	36	4	5
2-1/2	10	42	5	6
3	12	48	5	6
3-1/2	12	54	6	6
4	15	60	8	8

- 2. Provide pull boxes for angle or U pulls with minimum dimensions as follows:

- a. Have a distance between each conduit entry inside the box and the opposite wall of the box of at least 6 times the trade-size diameter of the largest conduit, this distance being increased by the sum of the trade size diameters of the other conduits on the same row on the same wall of the box, and
- b. Have the distance between the nearest edges of each conduit entry enclosing the cable at least six times the trade-size diameter of the larger conduit,
- c. For a conduit entering the wall of a pull box opposite to a removable cover, have a distance from the wall to the cover of not less than the trade-size diameter of the largest conduit plus six times the diameter of the largest conduit.

3. Provide splice boxes with the following minimum dimensions:

Conduit trade-size	Width (inches)	Length (inches)	Depth (inches)	Width increase per additional conduit (inches)
1	12	32	4	3
1-1/4	14	36	5	4
1-1/2	18	39	6	4
2	20	42	7	5
2-1/2	24	48	8	6
3	30	54	9	6
3-1/2	36	60	10	7
4	42	66	11	7

## 2.7 TERMINAL BOARDS

- A. Use 3/4 inch thick APA grade A-B interior plywood without voids
- B. Paint with two coats of white or light gray, intumescent latex, fire-retardant paint with a Class A fire rating. Manufacturer: Benjamin Moore "Retardo Latex Fire Retardant Paint".

## 2.8 GROUNDING

- A. Provide a ground bar for each terminal board.
  - 1. Furnish 12 inch x 4 inch x 1/4-inch copper ground bar with 1-inch standoff insulators.
  - 2. Drill ground bar with 7/16-inch bolt holes at (1 and 3/4) x 2 inch NEMA spacing for two-hole compression lugs.
  - 3. Manufacturers: Cadweld, Harger, Newton Instrument Co.
- B. Refer to Section 26 0526, Grounding and Bonding for Electrical Systems, for additional requirements.

## 2.9 CATEGORY 6A UTP CABLE (LANL-FURNISHED)

- A. Cable is UL listed as type CMP for use in ducts, plenums and air handling spaces.
- B. Cable consists of four 23 AWG unshielded twisted pairs; cable outside diameter is less than 0.31 inches.
- C. Manufacturer: Systimax GigaSpeed X10D

## 2.10 BACKBONE CABLE (LANL-FURNISHED)

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Edit article to match project requirements. Coordinate with the LANL Telecommunications Group.  
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- A. Copper backbone cable is ARMM cable, 24 AWG, UL listed as type CMR.
- B. Fiber optic backbone cable is UL listed as type OFNP or OFNR, tight buffered cable with a mixture of single-mode and multi-mode fibers.
- C. Television backbone cable is NRTL-listed type CATVP series 500 coaxial cable with an outside diameter of approximately 0.50 inches.

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Edit the following article to match project requirements. Delete if not required  
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## 2.11 TELECOMMUNICATIONS OUTLET/CONNECTORS (LANL-FURNISHED)

- A. Each GFE telecommunications outlet will consist of a plastic faceplate with four TIA/EIA-568-B configured RJ45 modular connectors.
- B. Cable connections are made to insulation displacing type connectors using an approved punch down tool.
- C. Manufacturer: Systimax

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Edit the following article to match project requirements. Delete if not required  
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## 2.12 CROSS-CONNECT EQUIPMENT (LANL-FURNISHED)

- A. The GFE will consist of Systimax X10 VisiPatch termination blocks. The quantity of blocks provided will be sufficient for the standard two-connection model work area channel.
- B. Horizontal cable connections are made to insulation displacing type connectors using an approved punch down tool.
- C. Manufacturer: Systimax X10D

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Delete the following article if there is no television system on the project.  
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## 2.13 COAXIAL DROP CABLE (LANL-FURNISHED)

- A. Drop cable is UL listed as type CATVP for use in ducts, plenums and air handling spaces.
- B. Cable: Type RG-6; cable diameter is approximately 0.25 inches.

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Delete the following article if there is no television system on the project.  
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## 2.14 TELEVISION OUTLETS/CONNECTORS (LANL-FURNISHED)

- A. Each television outlet consists of a plastic faceplate with one type "F" coaxial cable connector.
- B. Cable connectors are crimp-on type.

## PART 3 EXECUTION

### 3.1 EXISTING WORK

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Delete this article when existing construction is not affected.  
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- A. Remove exposed telecommunications cables, including abandoned cables above accessible ceiling finish. Patch surfaces where removed cables passed through building finishes.
- B. Remove abandoned raceways and boxes when telecommunications cables servicing boxes is abandoned and removed. Install blank cover for abandoned boxes not removed.
- C. Provide access to existing telecommunications cable connections remaining active and requiring access. Modify installation or install access panel.

### 3.2 EXAMINATION

- A. Verify interior of building has been protected from weather.
- B. Verify mechanical work likely to damage telecommunications cables has been completed.
- C. Verify telecommunications pathway installation is complete and supported.
- D. Verify that installation of telecommunications rooms is complete.
- E. Examine raceways and building finishes receiving telecommunications cables for compliance with installation tolerances and other conditions. Do not proceed with installation until unsatisfactory conditions have been corrected.

### 3.3 GENERAL

- A. Install telecommunications system according to NECA/BICSI 568, NEC Article 800, and requirements in this Section.



- B. Maintain separations between telecommunications pathways and sources of electromagnetic interference as indicated in Table 2 of NECA/BICSI 568.

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Edit the following article to match project requirements. Delete if not required

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### 3.4 CABLE TRAY INSTALLATION

- A. Install cable tray around the perimeter of each telecommunications room and above the equipment racks.

1. Locate cable tray with edge 8 inches from perimeter walls.
2. Provide six cable tray dropout fittings in each telecommunications room. Install cable tray dropout fittings at locations directed by the LANL Telecommunications Group.
3. Extend cable tray to each open telecommunications equipment rack.

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Edit the following article to match project requirements. Delete for single story structures.

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- B. Install vertical cable tray in telecommunications room(s) to support backbone cables rising to upper floors.
- C. Install cable tray system to distribute horizontal cables from the telecommunications room(s) to locations near the telecommunications outlets. Locate cable tray concealed above corridor lift-out ceilings. Connect to the cable tray in the telecommunications room(s).
- D. Install cable tray at least 5 inches away from fluorescent or HID lighting fixtures to prevent electromagnetic interference.
- E. Install cable tray so there will be not less than 12 inches above and to the side of tray to permit access for installing and maintaining cables. Locate cable trays below suspended mechanical equipment, piping, and ductwork that would impede access to the cable tray.
- F. Refer to Section 26 0536, Cable Trays for Electrical Systems, for additional installation requirements.

### 3.5 CONDUIT INSTALLATION

- A. Install the telecommunications service entrance conduits as indicated on the Drawings. Turn up the telecommunications conduits at the left rear corner of the telecommunications room adjacent to the left wall. Seal the building end of entrance conduits to prevent rodents, water, or gasses from entering the building.

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Edit the following article to match project requirements. Delete if not required  
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- B. Install conduits for backbone cables between telecommunications rooms.
  - 1. Install four 4 inch conduits between vertically associated telecommunications rooms.
  - 2. Install two 4 inch conduit between telecommunications rooms on the same floor.
- C. Install an individual 1" conduit for telecommunications horizontal cables from each telecommunications outlet to the telecommunications terminal board or telecommunications cable tray.
- D. Install an individual 1" conduit for television horizontal coaxial cable from each television outlet to the designated telecommunications room equipment rack, either directly or in a combination of telecommunications cable tray and conduit.

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Edit the following article to match project requirements.  
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- E. Install a 3/4" conduit from the telecommunications room to the elevator controller in the elevator equipment room. Coordinate installation with elevator contractor.
- F. Install a 3/4" conduit from the telecommunications room to the fire alarm control panel. Install a 6" x 6" x 4" box adjacent to the fire alarm control panel.
- G. Install conduit for telecommunications and coaxial cables in maximum lengths of 100 ft with not more than two 90-degree bends or equivalent redirection between any two adjacent conduit openings. Install a pull box at any reverse bend.
- H. Use bends on telecommunications conduits 2 inches trade size and smaller with a minimum inner edge radius 6 times the conduit internal diameter.
- I. Use bends on telecommunications conduits larger than 2 inches trade size with a minimum inner edge radius 10 times the conduit internal diameter.
- J. Do not use conduit bodies for changes in direction or as pull boxes.
- K. Install raceway measuring tape in empty raceways. Leave not less than 12 inches of slack at each end of the tape. Secure each end of tape.
- L. Install conduits and sleeves projecting through structural floors with opening 4 inches above the floor.
- M. Terminate each metallic telecommunications conduit in either an insulated throat fitting or an insulating bushing.

- N. Refer to Section 26 0533 Raceways and Boxes for Electrical Systems for additional installation requirements.

### 3.6 OUTLET BOX INSTALLATION

- A. Install outlets at locations indicated on the Drawings. Telecommunications outlet locations shown on the Drawings are in approximate locations unless dimensioned. Verify locations before rough-in.
- B. Locate each outlet within 36 inches of a suitable receptacle power outlet.
- C. Group and align telecommunications outlets and power outlets so a symmetrical appearance results.
- D. Refer to Section 26 0533, Raceways and Boxes for Electrical Systems, for additional installation requirements.

### 3.7 TERMINAL BOARD INSTALLATION

- A. Install pre-painted terminal board lining three walls of each telecommunications room from the floor to 8 ft above the floor.
- B. Install terminal boards plumb, and attach securely to the building structure with fasteners at not more than 24" on center vertically and horizontally.

### 3.8 GROUNDING INSTALLATION

- A. Install a ground bar at lower right corner of the left wall terminal board in each telecommunications room.
- B. Connect ground bar(s) to the building main electrode ground bar with 4/0 AWG 600V insulated ground cable. If the building structure is steel, bond the ground bar to the nearest structural steel using 6 AWG or larger conductor.
- C. Terminate 4/0 AWG ground cable in the telecommunications duct bank on the entrance telecommunications room ground bar.
- D. Run grounding cables exposed or, if exposed to physical damage, in Schedule 40 PVC conduits. Do not install grounding cables in ferrous metal conduit.
- E. Make connections to ground bar(s) and bonded objects using hydraulically compressed two-hole lugs. Clean connectors and connection points prior to fastening.
- F. Bond telecommunications cable tray to the ground bar with minimum 6 AWG. Install a 6 AWG grounding conductor in the cable tray; bond conductor to each cable tray section using listed cable tray ground clamps.

- G. Bond all metallic telecommunications raceways to the ground bar per ANSI/J-STD-607-A. Bond individual raceways with 12 AWG or larger conductor. Bond groups of raceways using minimum 6 AWG.
- H. Use approved fittings and minimum 12 AWG bonding jumpers to make telecommunications raceways electrically continuous.
- I. Use approved fittings to bond telecommunications conduits to cable trays.
- J. Refer to Section 26 0526, Grounding and Bonding for Electrical Systems, for additional installation requirements.

### 3.9 CROSS CONNECT EQUIPMENT INSTALLATION

- A. Cross connect equipment will be furnished and installed by the LANL Telecommunications Group.
- B. Entrance and backbone cabling will be furnished and installed by the LANL Telecommunications Group.
- C. Cross connect jumpers will be furnished, installed, and tested by the LANL Telecommunications Group.

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 Edit the following article to match project requirements.  
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### 3.10 CABLE INSTALLATION

- A. Handle and install horizontal cable according to cable manufacturers' instructions. Have the manufacturer's installation instructions available at the construction site.
  - 1. Do not subject horizontal cable to a bending radius of less than 1 inch.
  - 2. Do not subject horizontal cable to more than 32 lb pulling tension.
  - 3. Do not kink or excessively twist cable.
  - 4. Do not skin or damage cable sheath or conductor insulation.
- B. Obtain cable handling and installation requirements for backbone cable from the LANL Telecommunications Group.
- C. Examine raceways to receive cables for compliance with installation tolerances and other conditions. Do not proceed until unsatisfactory conditions have been corrected.
- D. Completely and thoroughly swab raceways before installing cable.

- E. Clean foreign matter from interior of boxes and conduits before installing cables.
- F. Store cable for 24 hours in the installation area ambient temperature before installing.
- G. Do not “through-pull” cables at boxes, fittings or cabinets where a change of raceway alignment occurs.
- H. Comply with Article 800 of the NEC.
- I. Install LANL-furnished backbone cables between telecommunications closets. Leave 15 feet of slack at each end. LANL will terminate backbone cables.
- J. Install 4 LANL furnished Category 6A UTP horizontal cables from each telecommunications outlet to the telecommunications terminal board or the telecommunications cabinet. Leave 15 feet of slack at the cross-connect end and 18 inches of slack at the outlet end.

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Delete the following articles if there is no television system on the project.

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- K. Install one coaxial cable from each television outlet to the telecommunications room equipment rack or splitter designated by the LANL Telecommunications Group. Leave 8 feet of slack cable at the equipment rack or splitter end and 18 inches at the outlet end.
- L. Terminate horizontal telecommunications cables on LANL-furnished telecommunications outlet/connectors in accordance with NECA/BICSI 568 and ANSI/TIA/EIA-568-B, designation T568B, per figure 6-2, Optional Eight Position Jack Pin/Pair Assignments, using an approved punch-down tool. Leave 12" of slack in cables. Coil cable into outlet box and install faceplate on outlet box.
- M. Terminate horizontal telecommunications cables on cross connect equipment in accordance with NECA/BICSI 568 and ANSI/TIA/EIA568-B using an approved punch-down tool. Terminate cables in ascending order by room number, cubicle or workstation, and port number as directed by the LANL Telecommunications Group.

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Edit the following article to match project requirements. Delete if not required

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- N. Terminate television horizontal coaxial cable on LANL-furnished television outlet “F” type coaxial cable connector. Leave 12 inches of slack in cable. Coil cable into outlet box and install faceplate on outlet box.

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Edit the following article to match project requirements. Delete if not required

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- O. Terminate television horizontal coaxial cables on LANL-furnished outlet “F” type coaxial cable connectors at the designated equipment rack in a

telecommunications room or on a designated splitter as directed by the LANL Telecommunications Group.

### 3.11 IDENTIFICATION

- A. Uniquely identify each cable at both ends using a numbering scheme that complies with NECA/BICSI 568 and ANSI/EIA/TIA-606 and instructions from the LANL Telecommunications Group; use a tag produced using a label printing machine.
- B. After cables are terminated, label and install LANL-furnished designation strips on the telecommunications outlet/connectors and cross connect equipment as directed by the LANL Telecommunications Group; use labels produced using a label printing machine.
- C. Install an identifying label on each conductor connected to the telecommunications ground bar(s). Band both ends of each grounding cable with green plastic tape.

### 3.12 ACCEPTANCE TESTING

- A. Perform acceptance test on each installed and terminated Category 6A UTP horizontal cable per NECA/BICSI 568 and ANSI/TIA/EIA-568-B. Replace cables that do not pass acceptance tests.
- B. Perform continuity acceptance test on each installed and terminated coaxial cable. Replace cables that do not pass acceptance tests.
- C. Provide records of tests to the LANL Telecommunications Group. LANL may spot test some cables.

### END OF SECTION

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Do not delete the following reference information:

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### FOR LANL USE ONLY

This project specification is based on LANL Master Specification 27 1000, Rev. 1, dated April 27, 2006.